Ch. 1-5 : Explor. data analys.

Ch. 6-10 : Inference

sample n=1500

45% ± 3%

42% - 48%

Inference =

- making conclusions
- about a pop.
- from data (sample)

Formal Stat. Inf = (Ch 6-10)

- same
- with a known degree of confidence

① Confidence Intervals

- estimating a population parameter (μ or p) — Ch. 6

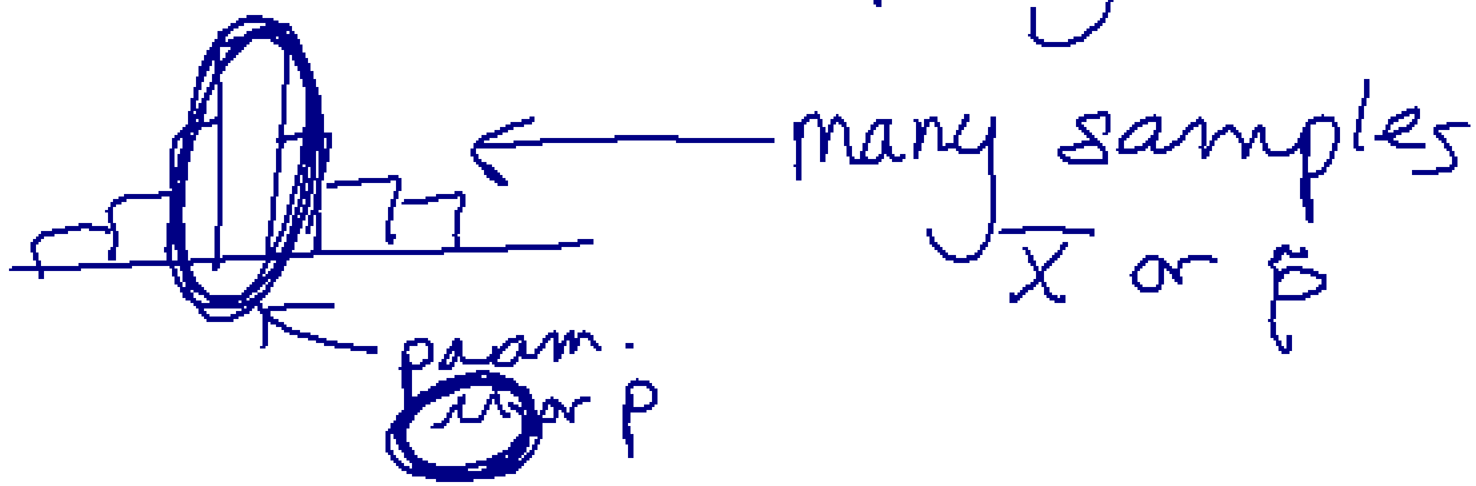
② Tests of Significance

- assesses the evidence for a claim about a pop. parameter

Ex: $\mu = 67\%$

$p = 30\%$

- based on sampling distrib.



- assumptions:
  - SRS (simple random sample)
  - good expt./study
- known σ (pop. std. dev)

- take samples
- find statistics ($\bar{x}$, s, $\hat{p}$, n)
- estimate parameters (μ, σ, p)
- $\mu > 10$ make conclusions about param. w/ a known degree of confidence
- write sentence(s) about conclusion (in context).

Conf. Int:

estimate ± margin of error.

(statistic)

$\bar{x}$ $\hat{p}$

45% ± 3% — 90%

45% ± 10% — 98%

- $\bar{X}$ is estimate (estimator)
- param = μ
- how accurate we believe our estimate is.
- how confident we are that our interval contains the true parameter.

① Interval (a, b)

45% ± 3%

(42%, 48%) ← 90% conf.

② Conf. level (C)

- gives prob. that in repeated samples, our interval contains true parameter. ← Sampl. distr.

- based on sampling distrib.

- $N(\mu, \sigma)$ — μ ← unknown; σ ← known

- $N(\mu, \sigma/\sqrt{n})$

<u>GENERIC</u>

statistic ± (critical value)(std. dev. of stat.)

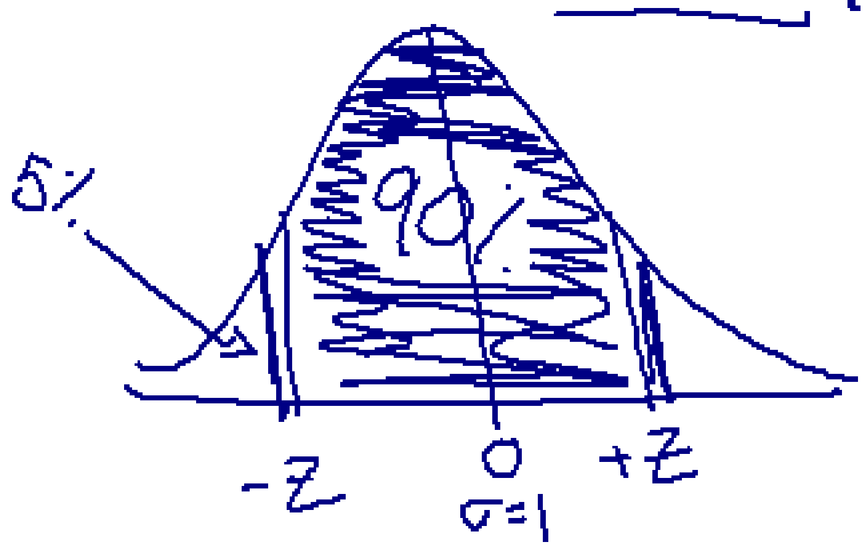
$$\hat{p} \pm (\quad)\left(\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right)$$

<u>SPECIFIC</u>

$$\bar{x} \pm (z^*)(\sigma/\sqrt{n})$$

$\sigma/\sqrt{n}$ ← $\sigma_{\bar{x}}$

- $\bar{X}$ = estimate for μ
- $\left(z^* \cdot \sigma/\sqrt{n}\right)$ = margin of error
- z^* = the z-score that has ____% of data btw $\pm z$



invnorm(0.05, 0, 1) = 1.645

- 90%
- 95%
- 99%

	90%	95%	99%
z^*	1.645	1.960	2.576

(1)

$$\bar{X} \pm Z^* \frac{\sigma}{\sqrt{n}}$$

$$25.7 \pm (1.96)\left(\frac{3.4}{\sqrt{100}}\right)$$

(25.0336, 26.3664)

μ

② $\sigma = 3$

$90\% \Rightarrow 1.645$

$n = 4$

$\bar{x} = 190.5$

$$\bar{x} \pm z^* \sigma/\sqrt{n}$$

$$= 190.5 \pm (1.645)(3/\sqrt{4})$$

$$= (188.0325, 192.9675)$$

Interpreting:

① Interval (a,b)

② Conf. level

- full sentence, in context
- both interval & level

We are _____ % confident that the true mean of __________ is btw _____ and _____ units.

We are 90% conf. that the true mean weight is btw 188.0325 and 192.9625 lbs.

Worksheet 6.1

#2)

std. dev = 2.4

a) (11.8565, 12.8435)

We are 90% confident that the true average life expectancy of batteries is btw. 11.8565 and 12.8435 months.

b) (11.9552, 12.7448)

We are 90% confident that the true average life expectancy of batteries is btw. 11.9552 and ~~12.8435~~ 12.7448 months

c) DECREASED (interval became narrower, smaller)

d) SRS, population st. dev. is known

#3)

a) (4.6298, 6.0102)

We are 95% confident that the true average drop in heart rate is between 4.6298 and 6.0102 beats/min.

b) (4.5008, 6.1392)

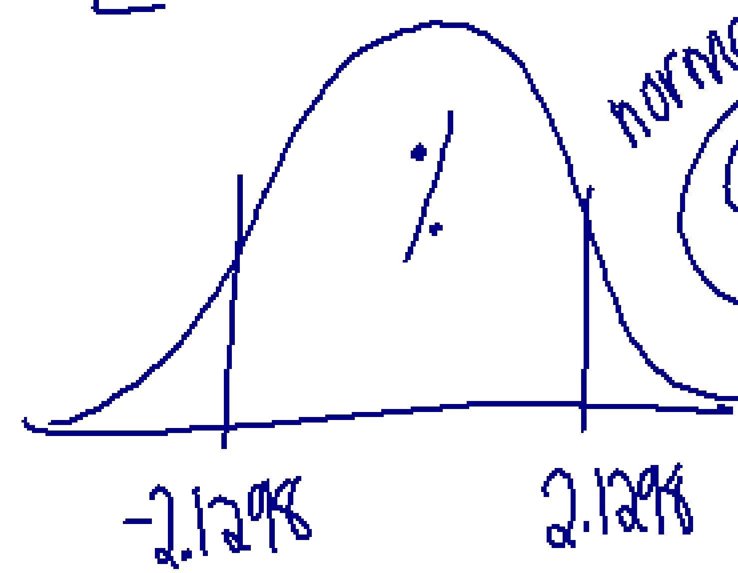
We are 98% confident that the true average drop in heart rate is between 4.5008 and ~~6.0102~~ 6.1392 beats/min.

c) 5.32 ± 0.75

$0.75 = z^* \cdot \frac{\sigma}{\sqrt{n}}$

$0.75 = z^* \cdot \frac{2.49}{\sqrt{50}}$

$z^* = 2.1298$



normalcdf(-z, +z, 0, 1)

96.68%

Go back to 6.1 worksheet from yesterday.

Do #1 (a) & (b)

ⓐ $\bar{x} \pm z^* \sigma/\sqrt{n} = (16.0608, 16.1392)$

We are 95% conf. that the true avg. ounces is btw. 16.0608 and 16.1392 oz.

ⓑ $\bar{x} \pm z^* \sigma/\sqrt{n} = (16.0485, 16.1515)$

We are 99% conf. that the true avg. ounces is btw. 16.0485 and 16.1515 oz.

Margin of error:

- $m = z^* \sigma / \sqrt{n}$

- Low and high conf.

(1) ↓ conf. level

(2) ↑ n

(3) ↓ σ (can't do)

Assumptions: (checks)

STATE	CHECK
① SRS	① circled or assumed
② σ known	② circled
③ normal pop. or $n \geq 30$	③ circled or $n = 100 \geq 30$ ✓

Cautions:

- can't use w/ other sampling methods (multistage, vol. resp.)
- can't use biased data
- $\bar{x}$, σ are non-resistant

can't use if outliers

*fix outliers

Choosing sample size:

- $\bar{x} \pm z^* \sigma/\sqrt{n}$
- m.o.e.
- $\uparrow n \Rightarrow \downarrow$ m.o.e.
- so we have a certain m.o.e.

$$m = z^* \sigma/\sqrt{n}$$

fill in (m, z^*, σ) — solve (n)

$$n = \left(\frac{z^* \cdot \sigma}{m}\right)^2$$

Ex: $m = 2$

$95\% \Rightarrow z^* = 1.96$

$n = ?$

$\bar{x} = 190.5$

$\sigma = 3$

$8.0001 \rightarrow 9$

$2 = z^* \cdot \sigma/\sqrt{n}$

$2 = \frac{1.96 \cdot 3}{\sqrt{n}}$

$n = 8.6436 \rightarrow 9$

worksheet:

1) $n = 42$

2) $n = 34$